Building for Future Precipitation

Stormwater infrastructure that collects and directs rainwater away from roads and buildings is sized based on historical rainfall events. For example, the amount of rain that falls within 24 hours is measured in one place over many years to establish how often the location receives different amounts of rain. Then a policy is established for what size stormwater system should be built. The policy should balance the upfront cost of building larger stormwater pipes and pumps and the long-term, community cost of flood damage when a rainfall event occurs that exceeds the capacity of the stormwater system.

Many localities require new developments to build stormwater drainage systems with the capacity to handle a 25-year storm. In Hampton Roads, a 25-year design storm is 6.99 inches of rain in 24 hours based on the current standard for rainfall data – a National Weather Service report called Atlas 14. The Atlas 14 report has not been updated for the Hampton Roads region since 2006. However, Virginia Beach with their consultant, Dewberry, analyzed local rainfall data and determined that in recent years larger storms were happening more frequently. The City adopted a local standard in June 2020 based on Atlas 14 plus a 20% increase. Now, a development that has to build a drainage system to handle a 25-year storm must have the capacity for an 8.39 inch rainfall event instead of 6.99 inch event.

If other localities in Hampton Roads localities continue to design drainage systems based on the Atlas 14 report, the drainage systems will fail more frequently and the community will have increased flooding. If the trend of larger, more frequent rainfall events accelerates, then the frequency and amount of flood damage will significantly increase over time. Updating Atlas 14 by including rainfall events after 2006 in the analysis would only address part of the problem. To size stormwater systems for the future, the design standard must include rainfall projections that reflect emerging climate trends.

Hampton Roads localities should pursue local, state and federal solutions to this challenge. Each solution has a different timeline but pursuing all of them concurrently would be a “no regrets” approach to reduce flood damage.

Recommendations:

Local Approach

All Hampton Roads localities should consider adopting the Virginia Beach design criteria of Atlas 14 plus 20%. The rainfall data used to establish this policy covers all of Hampton Roads so it is appropriate to use throughout the region. The new design criteria can be adopted by local ordinance and quickly require new developments to build the drainage capacity needed for the next 30 years instead of being undersized as soon as it is built. The region could develop a memorandum of agreement with state agencies, especially VDOT, requiring them to follow local design standards when constructing projects in the region.

State Approach

Virginia should invest in the research to analyze recent rainfall patterns across the entire state to determine future rainfall predictions. If there appears to be a pattern of increased or more intense rainfall in some parts of the state, then a new design standard should be established based on that data. The new standard should be incorporated into all the state agency programs such as DEQ’s stormwater regulation and VDOT’s construction projects. Key elements of this research endeavor and policymaking initiative should include:

1. Analysis of rainfall trends across the entire state
2. Analysis of changing rainfall trends to develop a predictive model
3. Evaluation of the uncertainty of the predictive model
4. Consideration of an iterative policy development including the concept of adding a safety factor to the existing design standard (Atlas 14 + 20%) until additional rainfall data establishes trends with less uncertainty
5. Commitment to reevaluate the data at least every five years

The State Approach could be implemented by tasking the VDOT Research Council or by funding the expansion of Chesapeake Bay Program's research on rainfall trends to include the whole state, instead of only studying the portion in the Chesapeake Bay watershed.

Federal Approach

Hampton Roads localities should encourage their congressional delegation to fund the National Weather Service to update its methodology for analyzing rainfall. Additional funding should be provided to update Atlas 14 every five years and include analysis of rainfall trends and climate projections to provide forecasts for changes expected in the next 10-30 years. Specifically, an appropriation under the Water Resources Development Act could be directed to support this approach.